BALLISTICS

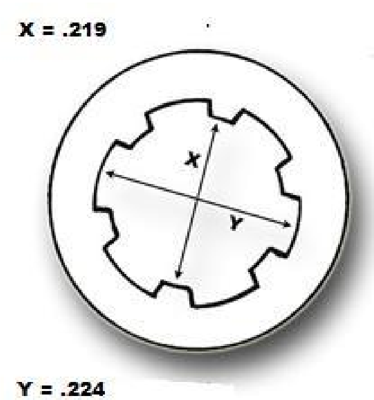
The study of ballistics can be broken down into three parts: *Internal Ballistics*, *External Ballistics*, and *Terminal Ballistics*. Internal ballistics encompasses what occurs inside the rifle barrel from the time the primer ignites until the bullet leaves the barrel. External ballistics is the study of what happens to the bullet while it is in flight. Terminal ballistics is what occurs to a target, in this case a human being, when struck by a bullet.

INTERNAL BALLISTICS

Internal ballistics starts with the ignition of the primer at the base of the rifle cartridge. This ignition causes the gunpowder inside the cartridge to rapidly burn, building up internal pressure. As the internal pressure within the cartridge increases, the malleable brass cartridge case expands until it comes in contact with the chamber walls and the bolt face. With the cartridge case tight against the chamber, the increasing gas pressure created by the burning powder finds the path of least resistance by forcing the bullet out of the cartridge case and down the barrel. As the chamber pressure from the burning powder increases, this pressure accelerates the bullet to higher velocities. The speed of a bullet is referred to as *Muzzle Velocity* and is measured in *Feet Per Second (fps)*. A Federal brand, 69gr. Match .223 BTHP bullet, for example, has a muzzle velocity of +/- 3000 fps as it leaves the muzzle of the rifle with a 20-inch barrel. 50,000 pounds per square inch (psi) of pressure, created by the rapidly burning gunpowder in the cartridge case accelerates the bullet to this speed.

A bullet's movement through the barrel is included in the study of internal ballistics. To be stabilized during flight and travel in a predictable path, the bullet must have a spin to it which creates a gyroscopic action much like that of a spiraling football or a child's spinning toy top. The rifling of the barrel creates this spin. The barrel is manufactured with the lands, the highest point of the rifling, and grooves, the lowest pint of the rifling, running from one end of the barrel to the other. These lands and grooves don't run down the barrel in a straight line, they have a *Twist* to them and may rotate clockwise or counter-clockwise, commonly referred to as right- or left-hand twist, as they twist down the length of the barrel. As the bullet is forced down the barrel, it follows the rifling and begins to spin.

Barrel twist rate is measured by one complete rotation of the bullet in a prescribed number of inches of barrel length. For example, a rifle barrel that causes the bullet to rotate 1complete turn in 12 inches is referred to as a 12-inch twist, or 1:12. A Colt M-16/AR-15 has a 1:12(slow), 1:9(medium), or a 1:7(fast) twist rate depending on what type of bullet the barrel was designed to shoot. Different bullet calibers and weights may require different twists and velocities to stabilize them; for example a 1:12 twist barrel may not stabilize bullets heavier than 60 grains, causing these bullets to yaw or wobble just like a poorly thrown football, making them inaccurate. The faster the twist the faster the bullet will rotate; generally speaking, longer bullets need to be spun faster to ensure stability. A .223 Remington bullet is actually .224 in diameter, the same size as **Y**, the width of the barrel rifling grooves, and is larger in diameter than the rifle bore **X**, the width of the rifling lands, as depicted in the picture to the right.



When the bullet is propelled from the cartridge case and impacts the rifling , a series of vibrations begin. The bullet initially strikes the rifling causing a *Longitudinal Vibration* or end-to-end vibration within the barrel. This is when the rifle recoils, moving backward into the marksman's shoulder. When the rifle can't move any farther to the rear, the barrel will start to rise upward, bowing in the middle of the barrel causing an up-and-down movement of the barrel. This whipping motion is known as *Vertical Vibration*. A marksman's positioning behind the rifle, improper grip, or a bedding problem of the rifle action causes a *Lateral Vibration*, or side-to-side movement, of the rifle barrel. As the bullet is forced down the barrel, the rifling imparts a spin to the bullet causing a *Torsional Vibration* to the barrel. All four of these vibrations occur at the same time and are referred to as *Barrel Whip*.

In order to ensure absolute accuracy, the barrel must vibrate in the same fashion every time the rifle is shot. This accuracy can be accomplished by using good quality, heavy rifle barrels, quality ammunition, consistency in the marksman's shooting position, and by having a barrel which is not touching the stock or any other external objects. A barrel which is not touching the stock is referred to as *Free-Floating*. If a marksman is consistent in his/her shooting and there are no problems associated with the rifle bedding, a free-floating barrel, or external influences on the barrel, the bullet will strike the target at the same location every time. If there are inconsistencies in any of these factors, the bullet strike will be somewhat different each time.

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EXTERNAL BALLISTICS

The study of external ballistics begins when the bullet leaves the muzzle of the rifle barrel and becomes a projectile traveling towards a target. There are three forces that influence a bullet's flight, *Gravity*, *Air Resistance* or *Drag*, and *Wind*.

Gravity is a constant force that draws all objects toward the center of the earth. As soon as the bullet leaves the rifle muzzle it starts dropping toward the earth. When marksmen speak of vertical drop, they're referring to the amount of drop, in inches, that the bullet experiences due to gravitational pull. So, the longer the time of flight of the bullet, the greater the amount of vertical drop, because gravity has more time to influence the bullet. The velocity of a bullet can minimize the effects of gravity. The faster a bullet can travel the distance to a target, the less time that gravity can act upon it. Since gravitational pull is constant, ballistic charts can predict how much vertical drop a bullet will have, at a specific velocity and distance.

Air resistance or drag is the force that slows the bullet down. The amount of drag that a specific bullet experiences varies depending on the bullet's velocity, shape, weight. As the bullet travels, it has to push air out of the way. This air is compressed in front of the bullet and then forced out of the way, sliding down the sides of the bullet. The movement of air down the sides of the bullet creates drag because of friction. The air moves from the sides of the bullet to the bullet's rear. This causes a vacuum to form, slowing the bullet even more. The shape and design of a bullet can reduce this drag. Environmental factors of altitude, temperature, and humidity also create drag in that the more dense the air the bullet passes through the more drag it experiences

Bullets are manufactured in a variety of shapes, sizes, calibers, and materials. Some designs are more efficient at traveling through the air than others. The efficiency of a bullet is referred to as the *Ballistic Coefficient (BC)*. The ballistic coefficient or BC is expressed as a three-digit number, which is always less than one. (e.g., .250, .530) The higher the number, the more efficient the bullet is in overcoming drag. A bullet's specific BC is found in ballistic charts. Generally speaking, the higher the ballistic coefficient, the flatter the bullet trajectory. External ballistics is better understood if a marksman is familiar with some basic terminology and physical principals of a bullet in flight. If a rifle barrel is held parallel to the surface of the earth and a bullet is then fired from it, the bullet will start to drop toward the surface of the earth immediately upon leaving the rifle barrel, because gravity is pulling it toward the earth surface. This is called the *Vertical Drop*. The horizontal line between the target and the rifle barrel is referred to as the *Base of Trajectory*. If a 6' tall marksman fired a rifle from a standing offhand position with the rifle being held approximately 5' from the ground, a .223 bullet traveling at 3000 feet per second (fps) would, unimpeded, fall to the ground at about a distance of 500 yards. In order to overcome or compensate for this vertical drop, a skilled marksman will intentionally aim a specific distance above the target. The target is referred to as the *Desired Point of Impact*. Where the bullet actually hits is referred to as the *Point of Impact*. Using their own rifle data or the commercially available ballistic charts, marksmen will know how much a bullet will drop at a variety of distances. The angle that is created between the base of trajectory and how far the rifle barrel is pointed above the desired point of impact is called the *Angle of Departure*. There are two other terms used in association with the rifle barrel and where it is pointed. The *Line of Elevation* is a straight line running down the bore of the rifle and going off into infinity. The *Line of Departure* is a straight line running down the bore of the rifle at the specific moment the bullet is fired. An unimpeded rifle bullet will never rise above the line of departure. A.223 bullet fired from a gun that has a 33-degree up angle will travel approximately 3 miles before striking the earth.

A marksman knows that at 100 yards a .223 BTHP bullet with a muzzle velocity of 3000 fps has a 4" vertical drop (this information is found on ballistic charts). The marksman will want to aim 4" above the desired point of impact prior to shooting at the target. This is a hard thing to do with any accuracy time and time again. To assist the marksman, adjustable front and rear sights are used. Where the rifle barrel is pointed, so are the sights. In order to shoot with accuracy, a marksman will want to center the front and rear sight on the desired point of impact, without having to estimate distances high or low. To facilitate this, the front and rear sights are moved up or down, left or right to compensate for the 4" vertical drop, instead of trying to estimate the distance at the target. The marksman adjusts sights up, down, left, or right. This creates a *Line of Sight* that is a straight line drawn between the marksman's eye, through the front and rear sights, and to the desired point of impact. The bullet usually crosses the line of sight twice: once just after firing, and a second time at the point of impact. After the rifle is fired, the bullet doesn't follow a straight line between the rifle barrel and the target. The actual path that the bullet follows is a curve and is known as the *Arc of Trajectory* or simply the *Trajectory*. The "arc" is caused by gravity pulling the bullet toward the ground. The bullet is spinning when leaves the rifle bore it and the bullet can spin either clockwise or counter clockwise depending on whether the barrel rifling has a right or left-hand twist. At longer distances, this spin or rotation will pull the bullet away from the original line of departure in the direction of the rotation, either left or right. This is called *Drift*. The natural drift of a specific bullet is found on the ballistic charts. Drift can also be caused by the wind.

There are a few other terms that are used in conjunction with external ballistics. The *Zero Distance* is the distance in which the rifle sights are adjusted so that the point of aim and the point of impact are the same. The most common zeroing distance used by police is 50 yards for an AR-15 rifle.

TERMINAL BALLISTICS

Terminal Ballistics is the study of a bullet from the moment it impacts a target until it stops. This study is often referred to as *Wound Ballistics* when it is used in conjunction with a human as the target.

The most effective way to incapacitate a person immediately is to severely damage or destroy the central nervous system. A shot to the brain usually stops all central nervous system activities immediately. Generally speaking, any high velocity rifle bullet that enters the cranial vault will result in immediate incapacitation. It is not necessary to target a specific part of the brain as the dramatic increase in cranial pressure caused by the entry of a high velocity rifle bullet will cause sufficient damage to result in immediate incapacitation; this however may not necessarily be the case with a low velocity bullet from a pistol or pistol-caliber carbine. A well-placed shot to the spinal column will stop all activities below the damaged area immediately but this target is significantly narrower in size than the cranial vault and is much more difficult to visualize. The tremendous impact of a rifle bullet that closely misses the spine can actually deliver the same type immediate incapacitation, shocking the spine without actually damaging it; this type of wound may only produce temporary incapacitation. Just remember, depending on the location of the impact to the spine, a spine hit may only leave the suspect less mobile but just as dangerous.

The second most effective target area is the high center chest area that contains the heart, lungs, and major blood vessels. This area is targeted in an attempt to lower the blood pressure which will eventually deprive the central nervous system of oxygenated blood. Even with the heart being destroyed and death inevitable a suspect can still function long enough to react in an adverse fashion. The rifle operator should use a bullet that has sufficient weight, bullet construction, and velocity to penetrate to the FBI’s standard of twelve to sixteen inches into the human body from any angle and through any out-stretched extremities.

The most important criterion for a bullet is its ability to penetrate a target so that it can damage the central nervous system or vital organs. Bullets entering the human body create two different types of wound channels. The first is a *Temporary Cavity* created by the tissue being moved rapidly outward away from the bullet’s path and then returning to its original position. This generally doesn’t cause much damage except to delicate tissue such as the brain or inelastic tissue such as the liver, kidney, or bone, as well as liquid filled organs such as the bladder. The second type of wound channel is called a *Permanent Cavity* and is the path created by movement of the bullet through the tissue. The permanent cavity is inside the temporary cavity. The permanent cavity is created by the bullet destroying tissue, organs, and bone that are directly in the path of the bullet or fragmented parts of the bullet.

A bullet entering a human body can do several things depending upon the construction of the bullet. Most bullets are made by what is known as the “cup and core” method; a lead core is placed in a jacket cup and both are then compressed into the desired shape with the mouth of the jacket cup extending toward the tip of the if the design is to be a soft point, a hollow point, or a polymer-tip. A full metal jacket bullet is made the same way only compressed in reverse; the mouth of the jacket now extends to the base of the bullet while the tip of the bullet is formed from what used to be the base of the jacket cup. The jacket material was originally designed to protect the soft lead core from the hard steel rifling of the barrel at high velocities, but designers learned that they could make the bullet perform differently by varying the thickness of the jacket material. A bullet formed with a thin jacket is designed to fragment or expand rapidly for minimal penetration while thicker jackets were used to slow the deformation of the bullet for deeper penetration.

Currently, some bullets are being made without any lead at all; they may be made of solid copper or gilding metal and are designed for deep penetration, or they may be made from a mix of compressed powdered metal plus bonding agent and are designed to be a “frangible” training round that will shatter back into powder to eliminate dangerous fragments when they hit hard steel target plates. It is important to understand that these non-lead bullets are made from lighter metals than lead-core bullets and will always be longer in length than the same weight, shape and caliber lead-core bullets; this may cause an issue with accuracy as the longer-for–weight bullets may require a tighter barrel twist to stabilize them. When we discuss bullet weight we are referring to a unit of weight measure known as “grains”, where 7,000 grains equal 1 pound or 437grains equals 1 ounce.

A soft point (SP) bullet can stay in one solid piece as it *Mushrooms* into a large diameter, destroying the tissue that it collides with or the bullet may *Fragment*, breaking up into many smaller pieces, if the jacket is thin enough and the bullet is driven at very high velocity; each of these fragments can create its own permanent and temporary cavity as it moves through the tissue away from the bullet path. Soft points can be readily indentified by the exposed lead tip, some having more lead exposed than others. The soft lead tip may exhibit feeding problems if the malleable lead tip catches on the rough feed ramp of some auto-loading loading rifles so function test these rounds before issuing them. A “bonded” soft point has the lead core attached to the thicker jacket, to insure that the two do not separate upon impact, and is designed for deep penetration by retarding and restricting the mushrooming of the front of this bullet. This leads to a narrower but deeper wound track and also makes this kind of bullet an excellent choice for barrier penetration. The current best example of a bonded SP is Federal’s Trophy Bonded Bear Claw bullet (TBBC) that is available as a 55gr. or 62gr. .223 load, or the 165gr .308Win load. These bullets are very expensive but far out-class all other bullets when it comes to glass penetration.

Polymer-tipped bullets, such as the Nosler Ballistic Tip or the Hornady V-Max, are nothing more than SPs with a polymer tip covering the lead tip. They can be had with light or heavy jacket to dictate performance and some may be of the bonded variety. The advantage of the polymer tip is that it may aid in feeding if a exposed lead tip SP is having problems in a particular weapon, and it lengthens and streamlines the bullet for a better ballistic coefficient.

Hollow point (HP) .223 rifle bullets have no lead showing and have a thin jacket drawn to a sharp tip with a very small opening. They are designed to violently fragment on impact with very minimal penetration and are used primarily for vermin eradication such as prairie dogs, ground squirrels, etc. and may not have sufficient penetration for law enforcement purposes.

There is another type of hollow point, the Open Tip Match (OTM), that does not fragment in this fashion as it has a much thicker jacket and is usually very heavy for caliber (75-80grains) which reduces its velocity. This bullet was not designed to expand or fragment and tends to wound in the same fashion as a military full metal jacket (FMJ) by *Yawing.* A non-expanding rifle bullet will become unstable as it starts to lose its spin when it hits a suspect. Being unstable, the momentum of heavier rear of the bullet will try to overtake the smaller and lighter front of the bullet, causing the bullet to turn sideways or yaw. When the bullet is sideways it creates a much larger wound channel than if it had continued nose-forward. When sideways, there is tremendous pressure against the side of the bullet and, if it has a cannelure or crimping groove, the bullet may snap in half which now creates two separate wound tracks. If the bullet does not snap in half it may continue to rotate another 90 degrees until it finally travels in a base-forward manner. If you have heard that a bullet tumbles in the human body, this is probably what that concept refers to as the bullet indeed can tumble 180 degrees until the bullet base is forward. Once the bullet base is forward, any more tumbling is unlikely as the bullet will want to continue on its path now that the heavier base is forward.

BARRICADE PENETRATION

One of the common misconceptions among people that are not familiar with firearms is that rifle rounds will penetrate targets more so than bullets fired from handguns. This is not necessarily true. A bullet's construction, type, and caliber will determine the penetration and potential for ricochet. The .223 caliber bullet is a small, high velocity round. When fired from an AR-15, the bullet is traveling at about 3,000 feet per second or better. When this bullet strikes a hard object, it fragments or breaks apart. This will limit the depth of penetration and the potential for the bullet to ricochet. Bullets fired from handguns and shotguns are larger and travel slower, yet studies consistently show that these rounds will penetrate farther and ricochet more violently than a .223 round.

Over the years, several agencies have conducted tests to determine how well a .223 round will travel through a barrier and then penetrate a target with sufficient energy left over to stop a suspect. These studies have included shooting through tires, car bodies, common auto and window glass, and residential construction walls. The bottom line is that the .223 round that a very common department issued round - the Federal 55-grain boat-tail hollow point - isn't the best choice for shooting through a barrier in order to stop a suspect. The test results discussed below were using a distance of 50 yards between the rifle and the target.

When fired through an automobile door, the .223 round will very likely penetrate the door and enter the vehicle interior. However, the bullet will tend to fragment and won't inflict serious injury to a suspect.

Tests conducted using inflated car tires show that using the .223 round will not create enough damage to the car tire to immediately stop the movement of the car. When shooting through the sidewall of the tire, through and thorough penetration will likely occur. However, the holes are small and the tires may immediately self-seal, limiting the air loss to a gradual deflation. Shooting through the tire rim immediately adjacent to the tire had more success it will make a .32 caliber hole in the rim and the tire immediately deflates.

It is possible to shoot through a vehicle windshield or side window and strike a suspect inside the car. Success is dependent on the angle to the windshield that the shot is fired from, and how far from the glass that the suspect is seated. A straight-on shot is better than a shot fired at a 45-degree angle to the window. The closer the suspect is to the glass, the more effective the shot will be. Remember that the vehicle front windshield is a more challenging barrier compared to the side and rear glass.

Tests conducted using a variety of commonly found glass showed a wide range of results. The results varied a great deal. Some shots went from completely ineffective, the bullet fragmenting and deflecting, and missing the target completely to striking the target with good penetration and results. The results are dependent on several factors: the distance from the rifle to the glass (the closer the better); the glass thickness and composition (the thinner the glass, the better); and the distance between the glass and the target (the closer the better). The angle of the rifle to the glass is also a factor: the smaller the angle, the better.

Test results indicate that an attempt to shoot through the exterior walls of a common house has a high rate of failure. The bullet will travel through the first wall and fragment. These fragments may or may not penetrate the interior wall. If they do, injury to a suspect is very limited.

Using Murphy's Law as a guideline, no matter how positive the test results are count on your round to not strike the target when fired through any type of a barrier. Count on the bullet deflecting or ricocheting and striking a target that you had not intended on hitting in the first place.

SELECTING PATROL RIFLE DUTY AMMUNTION

The discussion that follows deals with some of the issues that should be considered when selecting patrol rifle duty ammunition for a Law Enforcement agency. As your agency's subject matter expert, you should be able to articulate some rationale for the ammunition that is issued for duty use and this is best accomplished by understanding the primary mission of your agency and the particular rifle platform that is being used. Let's focus on the .223Remington/5.56 NATO cartridge which is the most prominent rifle caliber used in LE today.

What kind of chamber do you have, .223 Rem or 5.56 NATO?? The difference is that the 5.56 chamber has longer leade (tapered start of the rifling) to accommodate the longer military bullets. Firing 5.56 ammo in a .223 chamber can produce dangerous pressure spikes if the longer military bullet gets jammed into the shorter .223 Rem chamber leade; this can cause malfunctions or worse. .223 Rem ammunition is loaded to lower pressures than the military 5.56 NATO ammunition so when firing .223 Rem ammunition in 5.56 NATO chamber, it is not dangerous but you do have to ensure that that lower pressured ammo has enough pressure to operate the gas system properly. (See .223Rem vs. 5.56 NATO article below for more)

What is your rifling twist rate?? Older surplus M-16A1 have a 1-in-12 twist which stabilizes most bullet weights up to 60grains but anything heavier may begin to tumble erratically through the air. The more common 1-in-9" twist used by many of the current AR-15 manufacturers, will stabilize most of the bullet weights commercially available, 40-75 grains, but not some of the specialized very long and heavy bullets. The current US military 1-in-7" twist was designed to stabilize the overly long M856 tracer bullet and will handle just about anything available but, it can over-spin the very light fragile varmint-style bullets so much that the bullets may self-destruct by spinning apart after leaving the muzzle of the rifle.

What kind of bullet/projectile should be used?? This is the most complicated issue. The following article written by Dr. Gary K. Roberts makes specific recommendations of specific bullets to be used in specific situations. Most agencies will be better served to choose one that is more penetrating than less penetrating and the Roberts article will explain why.

Here are specific things that you want to ensure are present in your issued duty ammo:

1. The ammunition is loaded to NATO pressures (60,000psi) if used in 5.56 chambers; to commercial SAAMI pressures (50,000psi) if used in .223 Rem chambers.

   The below left headstamp shows a military cartridge case marked “LC 05”, which show that it was made at Lake City (Arsenal in Missouri) in 2005 and no caliber is designated. The “cross inside the circle” stamp denotes that it is made to NATO specification as all ammunition made for NATO members will have this symbol stamped on it. The below right headstamp shows that this cartridge is a commercially loaded round, manufactured by Winchester, and the caliber is designated as .223 Remington.

NATO symbol (circle with cross)

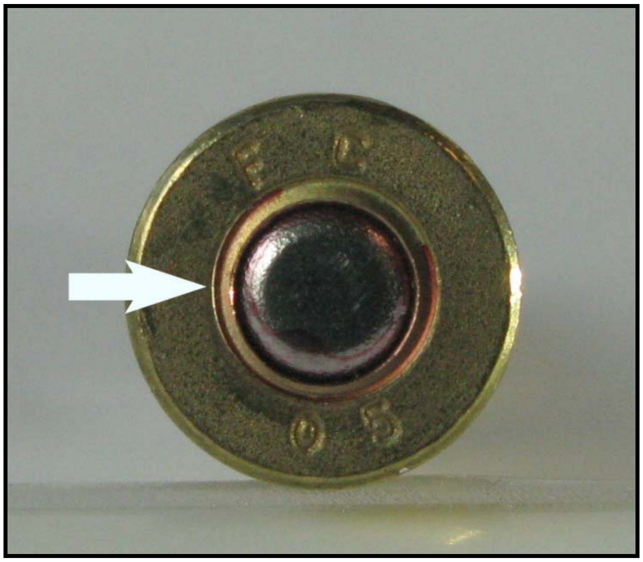
.223 REM manufactured by Winchester

Several different headstamps for comparison

2. The bullet should have a **cannelure** (crimping groove) with the case mouth crimped into it to prevent bullet set-back (bullet pushed back into the cartridge case) that might occur when the bullet hits the feed ramp while loading during the violent cycle-of-operation of semi/full-auto rifles. Non-crimped bullets will work fine in manually operated guns like that of a bolt-action rifle and will usually produce better accuracy.

Arrow indicating cannelure with crimp vs. the non-cannelured hollow point w/o crimp

3. The **primer should be crimped** in the primer pocket to ensure that the primer doesn't fall out during the violence of the firing cycle, or from over-pressures such as those created when firing 5.56 ammunition in non-5.56 chambers. When this happens, the primer, or worse the primer anvil, can fall into various areas of the rifle rendering it inoperable. Crimping is stamping a ring around the primer pocket that swages the brass there to form a tight ring around the edge of the primer. The below picture shows a headstamp on a crimped military 5.56 cartridge case **<u>not</u>** loaded to NATO pressures (no circle/cross), manufactured by Federal Cartridge (FC) in 2005 (05)



Arrow indicates crimp

Then below picture shows a non-crimped primer on a commercial .223 Remington cartridge case manufactured by Federal Cartridge (FC).

No Crimp. Primer pocket is chamfered or beveled

<u>CURRENT .223REM/5.56NATO DUTY LOADS</u> – by Dr. Gary K. Roberts

Only after proper foundational and ongoing repetitive refresher training, cultivating warrior mind-set, and ensuring weapon system reliability do you need to worry about ammunition selection. Most folks would be far better off practicing with what they have, rather than worrying about what is "best". As long as you know what your weapon and ammo can realistically accomplish, it is all just a matter of training and shot placement. I would much rather go into battle with a guy who practices 15,000 rounds a year using generic 55 gr FMJ out of his old M16A1 than with some guy that has the latest state-of-the-art ammo and rifle, but only shoots 500 rounds a year. If you need to delve into the arcane subject of agency duty ammunition selection, below are the state of the art choices in 5.56 mm/.223:

For LE Patrol use, where there is a high incidence of potential engagements around or involving vehicles, ammunition that is able to effectively penetrate intermediate barriers, particularly vehicle glass is critical. The best LE 5.56 mm/.223 loads for intermediate barrier penetration are the 62 gr Federal bonded JSP Tactical (LE223T3) and the similarly performing 55 gr Federal bonded JSP load (Tactical--LE223T1 or identical Premium Rifle--P223T2). The Nosler 60 gr Partition JSP, Remington 62 gr bonded JSP, Speer 64 gr Gold Dot JSP, Swift 75 gr Scirroco PT are also good choices. The Barnes all copper TSX bullets are great projectiles and offer good penetration through barriers, however, when first hitting a laminated automobile windshield intermediate barrier, the TSX bullets exhibit less expansion than a TBBC, as the Barnes jacket either collapses at the nose, the jacket "petals" fold back against the core, or the "petals" are torn off; this results in a caliber size projectile configured a lot like a full wadcutter, leading to deep penetration. This phenomena has been documented by the FBI BRF, as well as being noted in our testing. *None of the .223 OTM bullets, even the heavy 75 - 100 gr loads, offer acceptable performance through automobile windshield glass. FWIW, contrary to what many believe, 62 gr M855 FMJ is also not very good against glass. For military use, the M995 AP is the best choice for vehicles and glass.*

In those situations where intermediate barrier penetration is not a critical requirement, for example LE urban entries or long range shots in open conditions, then OTM, JHP, and JSP loads can offer good performance. If your expected engagement scenarios are at typical LE distances, say out to 200 yards, then either 5.56 mm or .223 SAAMI pressure loads are fine. For 1/7 twist barrels, the Hornady 75 gr OTM, Nosler 77 gr OTM, and Sierra 77 gr SMK OTM are all good choices. The experimental BH loaded 100 gr OTM exhibits impressive fragmentation, even at relatively low velocities, however while capable of shooting out to 600, it is optimized for 200 and under. If stuck with 1/9 twist barrels, the heavy 70+ gr loads are not universally accurate in all rifles and the 69 gr SMK OTM, the 68 gr Hornady OTM, the Winchester 64 gr JSP (RA223R2), the Federal 64 gr TRU (223L) JSP, Hornady 60 gr JSP, are likely to run accurately in the majority of 1/9 twist rifles. NOTE: With 1/12 twists, the best choices are the 55 gr Federal bonded JSP load (LE223T1 or P223T2) or Barnes 45 or 55 gr TSX bullets in order to ensure adequate penetration (*Note: the Barnes 53 gr TSX is a bit longer than the 55 gr TSX due to a different ogive and does not stabilize as consistently in all 1/12 twist barrels*).

For longer range precision weapons (like the Mk12) with faster 1/8 or 1/7 twist barrels I would choose one of the combat proven 5.56 mm (i.e. 5.56 mm NATO pressure loads, not .223 SAAMI pressure loads which run about 200 f/s slower) heavy match OTM loadings: either the Hornady 75 gr TAP (#8126N) using the OTM bullet w/cannelure or the equally good 77 gr Nosler OTM w/cannelure loaded by Black Hills, followed by the 77 gr Sierra Match King OTM--which, while exceedingly accurate, offers slightly reduced terminal effects.

Short barreled 5.56 mm weapons, such as the Colt Commando, Mk18 CQBR, HK416, HK 53, HK G36C, etc…offer advantages in confines spaces. If SBR’s are used with 1/7 twist barrels, the 62 or 70 gr Barnes TSX, the 75 gr Swift Scirroco PT, 75 gr Hornady OTM, 77 gr Nosler OTM, 77 gr SMK OTM, and 100 gr BH OTM loadings offer acceptable performance, as do all the bullets recommended for slower twists. For 1/9 twist SBR’s, stick with the Fed 55 or 62 gr Tactical bonded JSP's, the 60 gr Nosler Partition JSP, or the lighter Barnes TSX’s. Remember, with SBR’s, effective engagement distances are significantly reduced compared to the longer barreled carbines.

Keep in mind, that with non-fragmenting bullet designs, heavier bullet weights are not necessarily better, especially at closer ranges and from shorter barrels. As long as penetration and upset remain adequate, it is possible to use lighter weight non-fragmenting bullets and still have outstanding terminal performance. With fragmenting designs, a heavier bullet is ideal, as it provides more potential fragments and still allows the central core to have enough mass for adequate penetration. In addition, heavier bullets may have an advantage at longer ranges due to better BC and less wind drift.

Whatever projectile is used, it is best with a cannelure to prevent bullet set-back in semi-auto/auto weapons. Also, be cautious with the exposed lead on the JSP designs. Often they will run great for up to 200-300 rounds, but then mysterious feeding failures will begin as a result of lead build-up on the feed ramps. I have personally seen this occur with a variety of JSP's including 55 gr, 60 gr, and 64 gr in LE training courses. As soon as FMJ or OTM was substituted, all the feeding failures ceased.

Be sure to watch your ammo storage conditions. Temperatures above 150 deg F will degrade the powder and cause pressure spikes. Hint: Think locked metal conex containers in the mid-east, car trunks in the southern U.S., and storage areas near heaters in the northern U.S. Also be cautions of leaving a round in a very hot chamber; besides the obvious danger of a cook-off, the powder can also be damaged by the heat, leading to dramatically increased pressures when the round is eventually fired.

A large SWAT team in this area had a failure to fire from an M4 with Hornady TAP ammo during an entry--fortunately no officers were hurt and the suspect immediately threw down his weapon when the carbine went click instead of bang. After the incident was concluded, the team went to the range and expended the rest of their carbine ammo and had one additional failure to fire. This same team had 3 Hornady TAP rounds fail to fire in training a couple of years ago. When Pat Rogers was teaching a class at a nearby agency, there were 5 failures to fire using Hornady TAP ammo. In all 10 cases, there appeared to be good primer strikes, but no rounds fired. On analysis, the ammunition had powder and checked out otherwise.

However, despite what appeared to be good primer strikes, two problems were discovered. First, when accurately measured, some of the primer strikes had insufficient firing pin indentations. The failed round from the potential OIS incident had a primer strike of only .013"—the minimum firing pin indent for ignition is .017". In addition, the primers on the other rounds were discovered to have been damaged from repeated chambering. When the same cartridge is repeatedly chambered in the AR15, the floating firing pin lightly taps the primer; with repeated taps, the primer compound gets crushed, resulting in inadequate ignition characteristics--despite what appears to be a normal firing pin impression. **Once a round has been chambered, DO NOT RE-CHAMBER IT for duty use. Do NOT re-chamber it again, except for training. This is CRITICAL!!!**

Most LE agencies around here use the Hornady 75 gr TAP OTM, Federal 55/62 gr bonded Tactical JSP, or Winchester 64 gr JSP (it is on the state contract and is VERY inexpensive)--all have worked very well in actual officer involved shootings. For urban LE use, I've carried the Hornady 75 gr OTM in 30 rd mags and a few 20 rd mags of Federal Tactical 62 gr JSP for barrier situations.

Do short barrel 5.56 mm carbines have some limitations? Yes, especially beyond 100 yards, but BFD…learn what they are, train, and drive on. For LE urban work with lots of entries and mounted work I've used 10.5-11.5" LMT and Colt Mk18/Commando style weapons w/Aimpoint and Noveske KFH because, despite the ballistic compromise, for the mission this weapon type is the best choice. For GP/Patrol I've used a 16" Colt 6920 and Noveske N4 Light Middy with an Aimpoint and 3x magnifier in a LaRue LT649 (a S&B 1.1-4x Short Dot or a 3.5x TA11 ACOG are also good choices) -- pick the right tool for the job.

The Black Hills produced Mk262 uses the 77 gr Sierra Match King (SMK) OTM and is built as premium quality ammunition intended for precise long-range semi-auto rifle shots from the Mk12 rifle. It is great for its intended purpose. Mk262 has demonstrated improved accuracy, greater effective range, and more consistent performance at all distances compared to M855 when fired from current M16, Mk12, M4, HK416, and Mk18 rifles and carbines. However, despite this substantially improved performance, Mk262 is NOT necessarily the best choice for LE or most military combat use from carbines, as Mk262 still manifests the problems of poor intermediate barrier penetration and somewhat variable terminal performance inherent with the SMK design, as well as increased cost.

.223 Rem vs. 5.56mm – WHAT THE REAL DIFFERENCES ARE

There are a lot of questions about these two cartridges. Many people think they are identical - merely different designations for commercial and military. The truth is that, although somewhat similar, they are not the same and you should know the differences before buying either cartridge.

- The cartridge casings for both calibers have basically the same length and exterior dimensions.
- The **5.56** round, loaded to Military Specification, typically has higher velocity and chamber pressure than the .**223** Rem.
- The **5.56** cartridge case may have thicker walls, and a thicker head, for extra strength. This better contains the higher chamber pressure. However, a thicker case reduces powder capacity, which is of concern to the reloader.
- The **5.56**mm and .**223** Rem chambers are nearly identical. The difference is in the "Leade". Leade is defined as the portion of the barrel directly in front of the chamber where the rifling has been conically removed to allow room for the seated bullet. It is also more commonly known as the throat. Leade in a .**223** Rem chamber is usually .085". In a **5.56**mm chamber the leade is typically .162", or almost twice as much as in the **223** Rem chamber.
- You can fire .**223** Rem cartridges in **5.56**mm chambers with this longer leade, but you will generally have a slight loss in accuracy and velocity over firing the .**223** round in the chamber with the shorter leade it was designed for.
- Problems may occur when firing the higher-pressure **5.56**mm cartridge in a .**223** chamber with its much shorter leade. It is generally known that shortening the leade can dramatically increase chamber pressure. In some cases, this higher pressure could result in primer pocket gas leaks, blown cartridge case heads and gun functioning issues.
- The **5.56**mm military cartridge fired in a .**223** Rem chamber is considered by SAAMI (Small Arm and Ammunition Manufacturers Institute) to be an unsafe ammunition combination.

Before buying either of these two types of ammunition, always check your gun to find what caliber it is chambered for, then buy the appropriate ammunition. Most **5.56**mm rounds made have full metal jacket bullets. Performance bullets - soft points, hollow points, Ballistic Silvertips, etc. - are loaded in .**223** Rem cartridges. Firing a .**223** Rem cartridge in a **5.56**mm-chambered gun is safe and merely gives you slightly reduced velocity and accuracy. However we do not recommend, nor does SAAMI recommend, firing a **5.56**mm cartridge in a gun chambered for the .**223** Rem as the shorter leade can cause pressure-related problems.

Winchester Law Enforcement Ammunition - East Alton Illinois